

**PNP Germanium RF Transistor**

**AF 109 R**

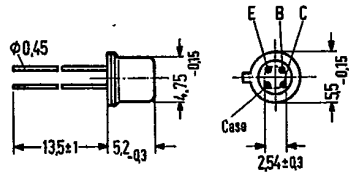
SIEMENS AKTIENGESELLSCHAFT 04053 D

**T-31-07**

for AGC input stages up to 260 MHz

AF 109 R is a germanium PNP RF mesa transistor in TO 72 case (18 A 4 DIN 41876). The terminals are electrically insulated from the case.

Type	Ordering code
AF 109 R	Q60106-X109-R1



Approx. weight 0.36 g Dimensions in mm

**Maximum ratings**

Collector-emitter voltage	$-V_{CE0}$	15	V
Collector-base voltage	$-V_{CBO}$	20	V
Emitter-base voltage	$-V_{EBO}$	0.3	V
Collector current	$-I_C$	10	mA
Emitter current	$I_E$	11	mA
Base current	$-I_B$	1	mA
Junction temperature	$T_j$	90	°C
Storage temperature range	$T_{stg}$	-30 to +75	°C
Total power dissipation ( $T_{amb} = 45^\circ\text{C}$ )	$P_{tot}$	60	mW

**Thermal resistance**

Junction to ambient air	$R_{thJA}$	≤ 750	K/W
Junction to case	$R_{thJC}$	≤ 400	K/W

**Static characteristics ( $T_{amb} = 25^\circ\text{C}$ )**

$-V_{CE}$ V	$-I_C$ mA	$-I_B$ μA	$h_{FE}$ $I_C/I_B$	$-V_{BE}$ mV
12	1.5	30	50 (> 20)	380 (320 to 430)
6	2	36	55	380 (320 to 430)
6	5	66	75	405 (360 to 450)

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**Static characteristics** ( $T_{amb} = 25^{\circ}\text{C}$ )

Collector cutoff current ( $-V_{CBO} = 20\text{ V}$ )	$-I_{CBO}$	0.5 (<8)	$\mu\text{A}$
Emitter cutoff current ( $-V_{EBO} = 0.3\text{ V}$ )	$-I_{EBO}$	0.5 (<100)	$\mu\text{A}$
Collector cutoff current ( $-V_{CEO} = 15\text{ V}$ )	$-I_{CEO}$	<500	$\mu\text{A}$

**Dynamic characteristics** ( $T_{amb} = 25^{\circ}\text{C}$ )

Reverse transfer capacitance ( $-I_C = 1\text{ mA}$ ; $-V_{CE} = 12\text{ V}$ ; $f = 450\text{ kHz}$ )	$-C_{12e}$	0.25	pF
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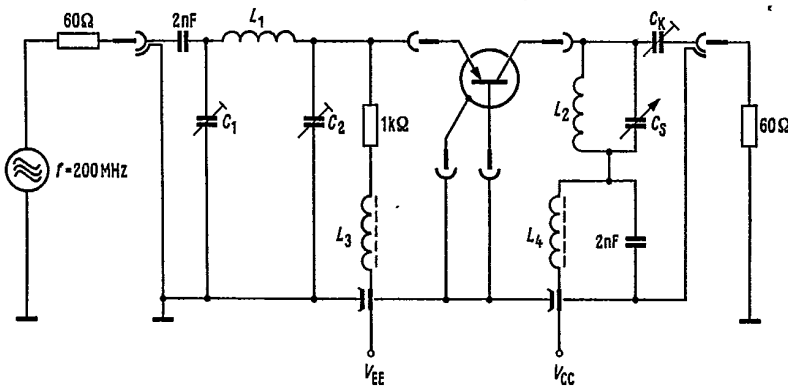
**Operating point:**

$-V_{CC} = 12\text{ V}$ ; $R_{EE} = 1\text{ k}\Omega$ ; $f = 200\text{ MHz}$			
Power gain ( $-I_C = 2\text{ mA}$ ; $R_L = 920\ \Omega$ )	$G_{pb}$	16.5 (>13)	dB
Noise figure ( $-I_C = 2\text{ mA}$ ; $R_g = 60\ \Omega$ )	NF	4 (<4.8)	dB
Adjustable amplification range ( $I_E \leq 9\text{ mA}$ )	$G_{pb}$	36	dB
Interference voltage at operating point of minimum cross modulation stability	$V_{int}\ 1\%$	22	mW

$V_{int} = 1\%$  is the rms value of half the EMF (terminal voltage under matching condition) of a 100% sine-wave modulated TV carrier with a generator impedance of  $240\ \Omega$ , which causes 1% amplitude modulation on the signal carrier.

$g_{11b} = 24\text{ mS}$	$g_{12b} = -0.2\text{ mS}$	$g_{21b} = -12\text{ mS}$	$g_{22b} = 0.2\text{ mS}$
$b_{11b} = -32\text{ mS}$	$b_{12b} = -0.16\text{ mS}$	$b_{21b} = 35\text{ mS}$	$b_{22b} = 1.6\text{ mS}$

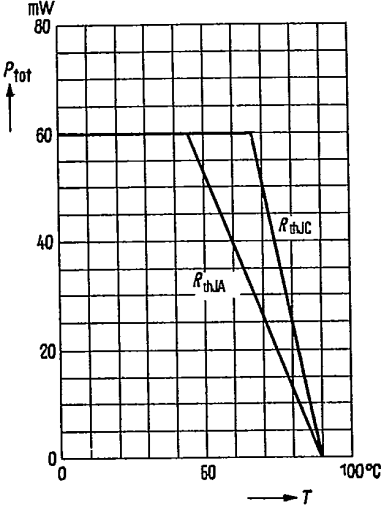
**Test circuit for power gain at  $f = 200\text{ MHz}$**



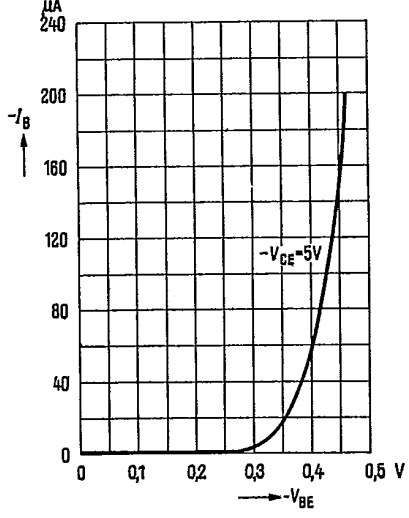
- $L_1 = 3\text{ turns}$ ;  $d = 1\text{ mm}$ ;  $\text{dia} = 6.5\text{ mm}$
- $L_2 = 2\text{ turns}$ ;  $d = 1\text{ mm}$ ;  $\text{dia} = 6.5\text{ mm}$
- $L_3 = L_4 = 20\text{ turns}$ ;  $0.5\text{ CuLs}$   
on core B63310-K-1A12,3
- $C_K = 1.5\text{ to }5\text{ pF}$ , so that  $R_L = 920\ \Omega$
- $C_1 = 6.5\text{ to }18\text{ pF}$
- $C_2 = 9.5\text{ to }20\text{ pF}$
- $C_3 = 3\text{ to }10\text{ pF}$

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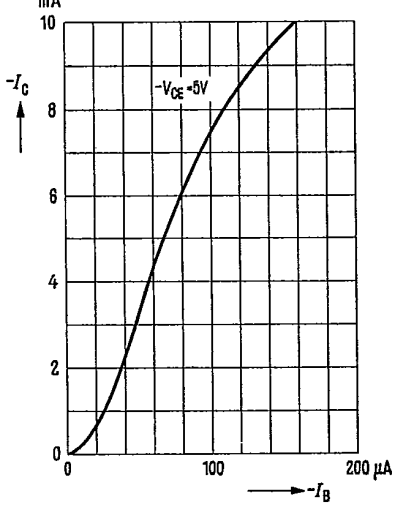
Total perm. power dissipation versus temperature  
 $P_{tot} = f(T)$ ;  $R_{th}$  = parameter



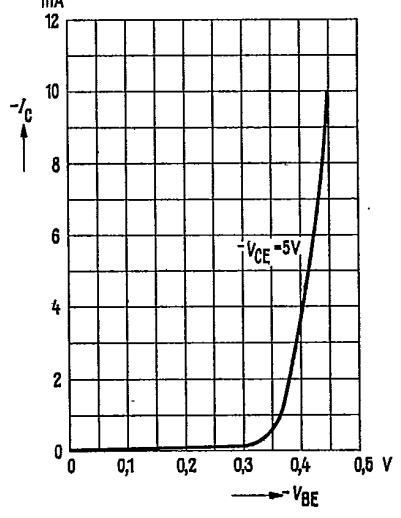
Input characteristic  $I_B = f(V_{BE})$   
 $-V_{CE} = 5V$   
 (common emitter configuration)



Collector current  $I_C = f(I_B)$   
 $-V_{CE} = 5V$   
 (common emitter configuration)

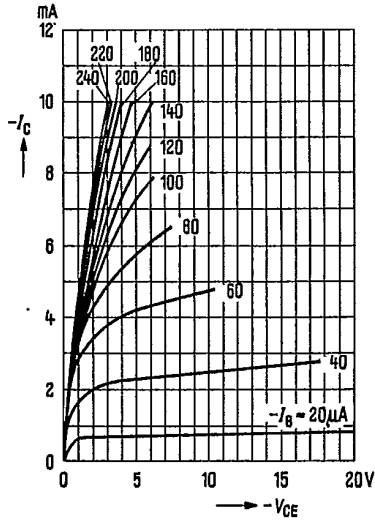


Collector current  $I_C = f(V_{BE})$   
 $-V_{CE} = 5V$   
 (common emitter configuration)

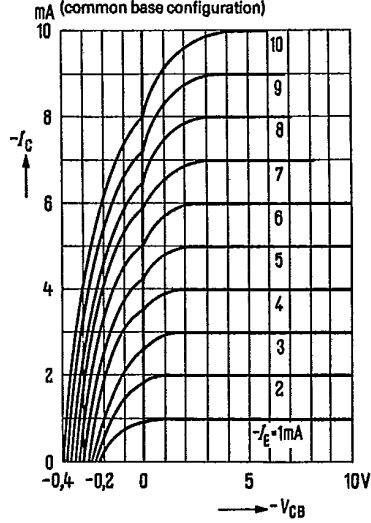


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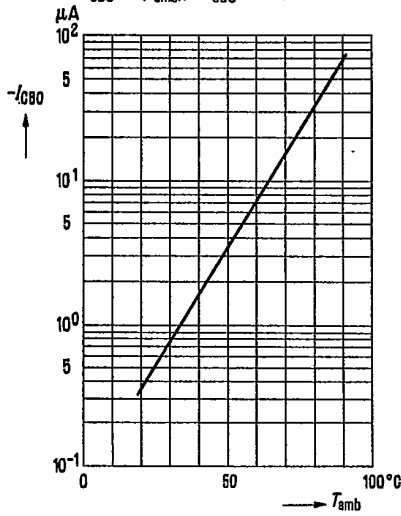
Output characteristics  $I_C = f(V_{CE})$ :  
 (common emitter configuration)



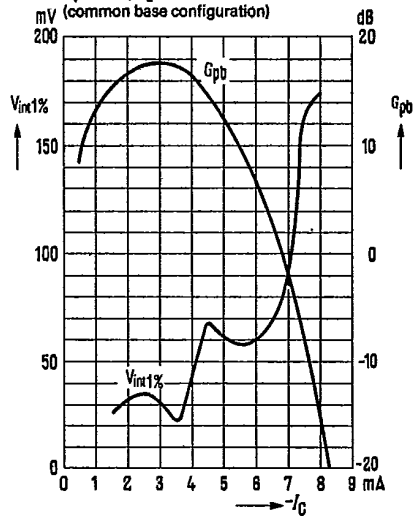
Output characteristics  $I_C = f(V_{CB})$ :  
 $I_E = \text{parameter}$   
 (common base configuration)



Collector cutoff current  
 versus temperature  
 $I_{CBO} = f(T_{amb})$ ;  $-V_{CBO} = 20V$

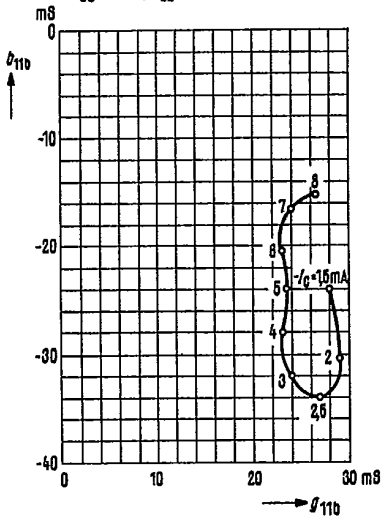


Interference voltage  $V_{int 1\%} = f(I_C)$   
 Power gain  $G_{pb} = f(I_C)$   
 $f = 200 \text{ MHz}$ ;  $-V_{beatt} = 12V$   
 $R_{sr} = 1 \text{ k}\Omega$ ;  $R_L = 0.9 \text{ k}\Omega$   
 (common base configuration)

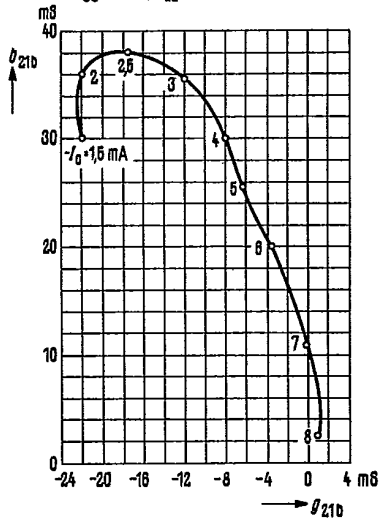


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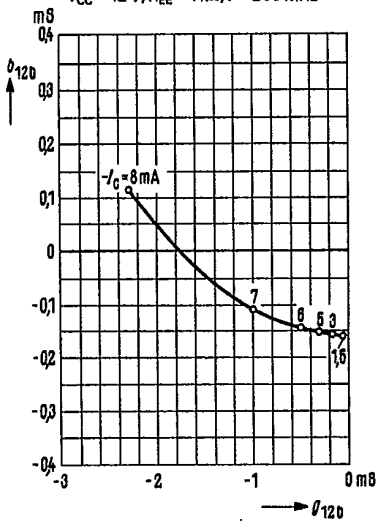
Small signal short circuit input admittance  $y_{11b}$   
 (common base configuration)  
 $-V_{CC} = 12\text{ V}; R_{EE} = 1\text{ k}\Omega; f = 200\text{ MHz}$



Small signal short circuit forward transfer admittance  $y_{21b}$   
 (common base configuration)  
 $-V_{CC} = 12\text{ V}; R_{EE} = 1\text{ k}\Omega; f = 200\text{ MHz}$



Small signal short circuit reverse transfer admittance  $y_{12b}$   
 (common base configuration)  
 $-V_{CC} = 12\text{ V}; R_{EE} = 1\text{ k}\Omega; f = 200\text{ MHz}$



Small signal short circuit output admittance  $y_{22b}$   
 (common base configuration)  
 $-V_{CC} = 12\text{ V}; R_{EE} = 1\text{ k}\Omega; f = 200\text{ MHz}$

